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Web Resources

Rational Expressions: www.mathwarehouse.com/algebra/rational-expression/

YouTube How to Add and Subtract Rational Expressions
www.mathwarehouse.com/algebra/rational-expression/how-to-add-subtract-rational-expressions.php

Graph Paper Maker (free): www.mathworksheetsgo.com/paper/

Online Graphing Calculator(free): www.mathworksheetsgo.com/calculator/

Addition and Subtraction of Rational Expressions-Like denominators

I. Model Problems

In these examples we will add, subtract, and find the restrictions for rational expressions.

Example 1: **Simplify and find the restrictions of** $\frac{x+2}{x+4}+\frac{x-3}{x+4}$.

Find the restrictions.

$$\begin{array}{r} x+4 = 0 \\ -4 \quad -4 \\ \hline x = -4 \\ x \neq -4 \end{array}$$

Add the numerators.

$$\frac{x+2}{x+4}+\frac{x-3}{x+4}=\frac{x+2+x-3}{x+4}$$

Simplify.

$$\frac{2x-1}{x+4}$$

Answer: $\frac{2x-1}{x+4}\, x \neq -4$

Example 2: **Simplify and find the restrictions of** $\frac{3x+2}{x^2+2x-8}-\frac{2x-2}{x^2+2x-8}$.

Factor the denominators.

$$\frac{3x+2}{(x+4)(x-2)}-\frac{2x-2}{(x+4)(x-2)}$$

Find the restrictions.

$$\begin{array}{r} x+4 = 0 \\ -4 \quad -4 \\ \hline x = -4 \\ x-2 = 0 \\ +2 \quad +2 \\ \hline x = 2 \\ x \neq -4,2 \end{array}$$

Distribute the negative. (Change addition to add the opposite.)

$$\frac{3x+2}{(x+4)(x-2)}+\frac{-2x+2}{(x+4)(x-2)}$$

Add the numerators.

$$\frac{3x+2+-2x+2}{(x+4)(x-2)}$$

Simplify.

$$\frac{x+4}{(x+4)(x-2)}$$

Cancel common factors.

$$\frac{(\cancel{x+4})}{(\cancel{x+4})(x-2)}$$

Answer: $\frac{1}{x-2}\, x \neq -4, 2$

II. Practice Problems

Simplify and find the restrictions.

1. $\frac{5}{3x}+\frac{2}{3x}$

2. $\frac{4}{3zb}+\frac{5}{3ab}$

3. $\frac{-12x}{5y}+\frac{14x}{5y}$

4. $\frac{16ab^2}{8yx}-\frac{7a}{8xy}$

5. $\frac{3a^2b}{4c^3}-\frac{-2a^2b}{4c^3}+\frac{-a^2b}{4c^3}$

6. $\frac{3y^2}{x+2}+\frac{5y^2}{x+2}$

7. $\frac{4y}{y-3}-\frac{5y}{y-3}+\frac{2y}{y-3}$

8. $\frac{9x}{2x-5}+\frac{3x^2}{2x-5}+\frac{12}{-5+2x}$

9. $\frac{6xy^2}{4a+12}+\frac{3xy^2}{4a+12}-\frac{xy^2}{4a+12}$

10. $\frac{3xy^5}{15x-20}+\frac{8xy^5}{15x-20}+\frac{14xy^5}{15x-20}$

11. $\frac{5x}{x^2+4x+3}+\frac{6x}{x^2+4x+3}$

12. $\frac{4x+5}{x^2-3x-28}+\frac{-2x+8}{x^2-3x-28}$

13. $\frac{x}{x^2-y^2}-\frac{y}{x^2-y^2}$

14. $\frac{2x+5}{x^2-x-6}-\frac{x-8}{x^2-x-6}$

15. $\frac{3y+2}{4y^2+11y+6}+\frac{4y-8}{4y^2+11y+6}$

16. $\frac{3x+5}{4x^2+6x+9}-\frac{2x+8}{4x^2+6x+9}$

17. $\frac{3x^2-7}{6x^2+27x+12}+\frac{2x+5}{6x^2+27x+12}$

18. $\frac{4x^2-2x+2}{6x^2+7x-3}-\frac{4x^2-5x+3}{6x^2+7x-3}$

19. $\frac{-7x+5}{4x^2-4x+1}-\frac{3x+2}{4x^2-4x+1}+\frac{12x-4}{4x^2-4x+1}$

20. $\frac{3x^2+7x+1}{x^2+6x+8}-\frac{2x^2+10x+11}{x^2+6x+8}$

III. Challenge Problems

1. Find the student's error.

$$\frac{5x+3}{3x+7}-\frac{2x+5}{3x+7}, x \neq -\frac{7}{3}$$

$$\frac{5x+3}{3x+7}+\frac{-2x+5}{3x+7}$$

$$\frac{3x+8}{3x+7}, x \neq -\frac{7}{3}$$

2. Find the student's error.

$$\frac{9x+4}{4x+3}-\frac{6x+7}{4x+3}+\frac{x-3}{4x+3}, x \neq -\frac{3}{4}$$

$$\frac{9x+4}{4x+3}+\frac{-6x-7}{4x+3}+\frac{x-3}{4x+3}$$

$$\frac{\cancel{4x}-6}{\cancel{4x}+3}$$

$$\frac{-6}{3}$$

$$-2, x \neq -\frac{7}{3}$$

IV. Answer Key

1. $\frac{7}{3}, x \neq 0$
2. $\frac{3}{ab}, a \neq 0\ b \neq 0$
3. $\frac{2x}{5y}, y \neq 0$
4. $\frac{16ab^2-7a}{8xy}, x \neq 0\ y \neq 0$
5. $0, c \neq 0$
6. $\frac{8y^2}{x+2}, x \neq -2$
7. $\frac{y}{y-3}, y \neq 3$
8. $\frac{3x^2+9x+12}{2x-5}, x \neq -\frac{5}{2}$
9. $\frac{2xy^2}{a+3}, a \neq -3$
10. $\frac{xy^5}{x-4}, x \neq 4$
11. $\frac{11x}{x^2+4x+3}, x \neq -3, -1$
12. $\frac{2x+13}{x^2-3x-28}, x \neq -7, -4$
13. $\frac{1}{x+y}, x \neq y, x \neq -y$
14. $\frac{1}{x+2}, x \neq -2$
15. $\frac{7x-6}{4y^2+11y+6}, , y \neq -2, -\frac{3}{4}$
16. $\frac{x-3}{4x^2+6x+9}, x \neq -3$
17. $\frac{3x^2+2x-2}{6x^2+27x+12}, x \neq -4, -\frac{1}{2}$
18. $\frac{1}{2x+3}, x \neq -\frac{3}{2}, \frac{1}{3}$
19. $\frac{1}{2x-1}, x \neq \frac{1}{2}$
20. $\frac{x-5}{x+4}, x \neq -4, -2$

Challenge Problems

1. Did not distribute negative to all terms of numerator of 2nd rational expression.
2. Cannot cancel like addends; only factors may cancel.